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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants:	Joseph A. FERNANDO et al.	Docket No.:	UNF-9058 A
Filed:	April 28, 2000	Group Art Unit:	1764
Serial No.:	09/560,469	Examiner:	Hien TRAN
Title:	Support Element For Fragile Structures Such as Catalytic Converters		

Certificate of Mailing

I hereby certify that this correspondence is being deposited on the date shown below with the United States Postal Service as first class mail in an envelope with sufficient postage addressed to: Mail Stop Amendment, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Linda K. Foster	Linda K. Foster	APRIL 27, 2006
(type or print name of person signing paper)	(signature of person mailing paper)	(date)

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DECLARATION OF JOSEPH A. FERNANDO UNDER 37 C.F.R. §1.132

To the Honorable Commissioner For Patents:

I, Joseph A. Fernando, hereby declare and say that:

1. I am a resident of the City of Amherst, in the State of New York.

2. I am an inventor of the invention described and claimed in the above-identified U.S. patent application entitled "Support Element For Fragile Structures Such as Catalytic Converters."

3. **Education**

I graduated with Honors from the New Mexico Institute of Mining and Technology (Socorro, New Mexico, U.S.A.) in 1990 with a Bachelor of Science (B.S.) Degree in Materials Engineering.

I obtained a Master of Science Degree (M.S.) with Honors in Materials Engineering from the New Mexico Institute of Mining and Technology in 1992. My Master's Thesis Topic was related to "Interface Engineering In Nextel 480 Ceramic Fiber/Glass Composites Using Boron Nitride as an Interphase."

I was awarded a Doctor of Philosophy (Ph.D.) Degree in Mechanical Engineering from the State University of New York at Buffalo in 2001. My Ph.D. Dissertation Topic was related to the development of a ceramic fiber based air/gas filter membrane material for use in high temperature gas filtration applications to control particulate pollution.

4. **Relevant Professional Affiliations/Memberships**

I am a Member of American Society of Mechanical Engineers, American Ceramic Society, American Filtration Society, The Metals, Minerals and Materials Society, and The American Paper and Pulp Institute. I am also a Member of, and the Unifrax Corporation Representative to, the Industrial Research Institute.

5. **Academic Research Experience**

From May, 1990-August, 1992, I held the position of Graduate Research Assistant in the Materials and Metallurgical Engineering Department at the New Mexico Institute of Mining and Technology. In this position, I evaluated and analyzed fracture toughness, strength and other behavior of ceramic fiber composites, and also investigated processing of ceramic fiber composites.

From August, 1992-May, 1994, I held the position of Research Project Assistant in the Mechanical Engineering Department at the New Mexico Institute of Mining and Technology. In this position, I evaluated and analyzed the time-dependent fracture behavior of ceramic fiber reinforced brittle materials and developed models to study the degradation of ceramic fibers in a brittle matrix.

6. **<u>Relevant Professional Industry Experience</u>**

From May, 1994-April, 1995, I was employed as a Mechanical Engineer at Advanced Refractory Technologies, Inc. (Buffalo, New York). In this position, I investigated coating methods in metal infiltration of ceramic fiber performs, conducted mechanical testing of ceramic materials, evaluated ceramic heat-exchange materials, and examined properties and crystalline behavior of ceramic materials.

From April, 1995-April, 1996, I was employed as a Materials Process Engineer at Washington Mills Electro Minerals Corporation (Niagara Falls, New York). In this position, I supervised and coordinated company efforts relating to the selection of new materials and equipment for processes requiring extreme temperature stability and high wear resistance, planned and coordinated improvements to existing processes to improve efficiency and productivity, and managed, coordinated and monitored development of new products and processes.

Since May, 1996, I have been employed by Unifrax Corporation (Niagara Falls, New York). During this time, I have held various positions within Unifrax Corporation (Senior Research & Development Engineer, May, 1996-October, 1999; Principal Research & Development Engineer, October, 1999-October, 2000; Manager of New Product Development, October, 2000-April, 2005; and Manager of New Products and Business Development, April, 2005–presen t).

7. As I am one of the inventors named on the above-identified U.S. patent application, United States Serial No. 09/560,469, I am familiar with the subject invention.

Described and claimed in the application is a device for the treatment of exhaust gases. The device comprises a housing, a fragile structure resiliently mounted within the housing, and a support element in the form of a mounting mat disposed between the housing and the fragile structure. The mounting mat comprises an integral, substantially non-expanding ply of melt-formed ceramic fibers containing alumina and silica having about 5 to about 50 percent crystallinity as detected by x-ray diffraction and a crystallite size of about 50Å to about 500Å. The mounting mat is capable of exerting a minimum residual pressure for holding the fragile structure within the housing of at least one of i) at least about 4 psi upon at least 200 cycles and/or at least 1000 cycles testing at a nominal temperature of 900°C or ii) at least about 10 psi after at least 1000 cycles of testing at 750°C.

Also provided is a method for preparing a mounting mat structure. The method comprises (1) providing melt-formed ceramic fibers containing alumina and silica having about 5 to about 50 percent crystallinity as detected by x-ray diffraction and a crystallite size of about 50Å to about 500Å, (2) mixing the fibers with a binder to form a slurry, (3) forming the slurry into a mat structure, and (4) removing the binder.

Further provided is a method for mounting a fragile structure within a housing to provide thermal insulation and mechanical shock resistance to the fragile structure. The method comprises (1) providing a flexible support element comprising an integral, substantially non-expanding ply of melt-formed ceramic fibers containing alumina and silica having about 5 to about 50 percent crystallinity as detected by x-ray diffraction and a crystallite size of about 50Å to about 500Å, (2) wrapping the flexible support element around the entire perimeter of at least a portion of the fragile structure, (3) forming a housing around the wrapped structure, and (4) radially compressing the support element between said structure and said housing.

8. **Office Action**

I understand that the Examiner has rejected all pending claims as being obvious, in view of the combination of U.S. Patent No. 5,580,532, JP 07-286,514 and GB 1,481,133. It is specifically alleged that it would be obvious to one having ordinary skill in the art to provide the fibers of the mounting mat of U.S. Patent No. 5,580,321 with a crystalline structure having a specific percent crystallinity as JP 07-286,514 and crystallite size of the fibers of GB 1,481,133.

9. U.S. Patent No. 5,580,532

U.S. Patent No. 5,580,532 describes an exhaust gas treatment device having a housing and a fragile catalyst support structure mounted in the housing with a mounting mat of ceramic fibers. U.S. Patent No. 5,580,532, however, does not provide any guidance or motivation to provide a mounting mat of ceramic fibers having the claimed crystallinity and crystallite size.

10. **JP 07-286,514**

JP 07-286,514 ("JP '514") discloses a catalyst "holder" for an exhaust gas treatment device. The holder comprises a blanket of alumina fibers of mullite composition. The fibers of JP '514 are strictly limited to fiber compositions having a weight ratio of Al_2O_3:SiO_2 of 70:30 – 74:26. JP '514 teaches one of skill in the art that when the Al_2O_3:SiO_2 ratio is not in the range of 70:30 – 74:26, fiber deterioration occurs prematurely and the fibers do not withstand long usage. JP '514 does not provide guidance or motivation to utilize aluminosilicate fibers having a weight ratio of Al_2O_3:SiO_2 that is outside of the range of 70:30 – 74:26 in the formation of the "holder" for an exhaust gas treatment device, and in fact teaches against such aluminosilicate fibers outside the disclosed weight ratio range.

11. **<u>GB 1,481,133</u>**

A conventional blanket prepared in accordance with teachings of GB 1,481,133 would not be suitable as a mounting mat for exhaust gas treatment device applications. It is appears that GB 1,481,133 discloses that these blankets are used for conventional industrial-scale thermal insulation applications. Conventional blankets, such as those described in GB 1,481,133, are prepared by a dry needling process in which there is no special effort made to minimize fiber breakage.

The needling process is used to densify a lofty blanket into a form that can be used as an insulating blanket. In addition to high temperature capabilities, the typical physical design targets of a thermal insulating blanket include density, tensile strength and z-direction resiliency, but does not include 'pressure exertion' (i.e. – "holding force") in the z-direction. Z-direction resiliency and z-direction pressure exertion are not the same thing. It is conceivable that a heat treated needled thermal insulating blanket made up of damaged and broken fibers may have an improved resiliency for 1 or 2 cycles, but it is inconceivable to expect such a needled blanket to have the necessary pressure exertion to hold a substrate in place and to do this for thousands of cycles, as required by the exhaust gas treatment device application.

Furthermore, the needled insulation blankets disclosed in GB 1,481,133 typically contain about 50 percent shot. The term "shot" is an industry accepted term to define unfiberized, particulate ceramic material. The shot material does not contribute to the minimum holding force requirements of a mounting mat structure. In addition, a mounting mat having this level of unfiberized shot content would significantly degrade under vibration conditions encountered during normal exhaust gas device operating conditions. The shot particles act as miniature pellets that get thrashed around in a small space under very high frequency and g-load conditions. The degrading effect of the shot particles is akin to the mechanism seen in 'sandblasting' where tiny sand grains when accelerated to high velocities

can be very aggressive in removing/cleaning metal, paint and so on. On a micro-scale a similar phenomenon is occurring with the shot particles in a mounting mat, resulting in the shot particles damaging the individual fibers and the fiber structure of the mounting mat. Consequently, a blanket as described in GB 1,481,133 composed of crystalline ceramic fibers to provide greater stiffness to the blanket would still not be sufficient to overcome the degrading effect of the high shot content and broken fibers resulting from the needling process.

12. **U.S. Serial No. 09/460,569**

The mounting mat described in the present application may be prepared by a wet papermaking processes, vacuum forming, or dry air laying. The wet paper making process includes preparing a slurry of the fibers, binder, water and optionally flocculating agents. The slurry is placed on any standard papermaking machine and plies of ceramic fiber paper are prepared. Alternatively, the ceramic fiber paper plies may be formed by vacuum casting the slurry of fibers, binder and water. In each case, the mounting mat plies are vastly different in composition, structure and properties from the conventional ceramic fiber blankets described in GB 1,481,133.

13. Without limitation, the mounting mats described in the present application are relatively thin (about 1mm to about 25mm) and lightweight materials (about 50 to about 6400 g/m^2). By contrast, the needled blankets described in GB 1,481,133 are generally thicker (0.5 to 2.5 inches) and heavier (6 to 12 lbs/ft^3).

14. Additionally, GB 1,481,133 is concerned with material integrity and insulation efficiency of the fiber blankets. By contrast, the main technical issue for mounting mat applications is the minimum holding force that the mounting mat is able to exert to hold the fragile catalyst support structure in position within the housing. GB 1,481,133 does not address or remotely contemplate the issue of holding force capability of the insulating fiber blanket.

15. Based on my experience in this field, as one having at least ordinary skill in the art, it is not appropriate to simply substitute a conventional ceramic fiber blanket as described in GB 1,481,133, which has different weights, dimensions and structural properties, for the mounting mat described in U.S. Patent No. 5,580,532. Furthermore, reading JP '514 would lead one having ordinary skill in the art away from using any fibers having a compositional range and ratio is outside of 70:30 – 74:26 for Al_2O_3:SiO_2.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Joseph A. FERNANDO

4/24/06
Date